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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/547,844

09/02/2005

Satoshi Sugahara

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EXAMINER

SANDVIK, BENJAMIN P

ART UNIT

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2826

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DELIVERY MODE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/547,844	Applicant(s) SUGAHARA ET AL.	
	Examiner Ben P. Sandvik	Art Unit 2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 December 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3,5-17,40-60,62-65,67-81 and 83-86 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-3,5-17,40-60,62-65,67-71,80,81 and 83-86 is/are allowed.
- 6) ☒ Claim(s) 72-79 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>2/21/2008</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments, filed 12/10/2007, have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Kirczenow.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 72, 75, 77-79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kirczenow (U.S. Patent #6355953), in view of Hsu et al (U.S. Patent #6753562).

With respect to **claim 72**, Kirczenow teaches a source and a drain (Fig. 5, 54/56) formed with ferromagnetic semiconductors (see Col 13-14, for example CoS₂); a semiconductor layer that is provided associated with the source and the drain, and has a channel of the first conduction type formed therein (Fig. 5, 52); and a gate electrode that is formed as opposed to the semiconductor layer (Fig. 5, 61), wherein the ferromagnetic semiconductors in the source and the drain are directly contacted with the semiconductor channel; but does not teach that the ferromagnetic semiconductors are of a first conduction type, i.e. the same conduction type as the semiconductor layer. Hsu teaches ferromagnetic

semiconductors that can be doped to the same conduction type as a semiconductor material (Col 6 Ln 52-58). It would have been obvious to one of ordinary skill in the art at the time the invention was made to doped the ferromagnetic semiconductors of Kirczenow as taught by Hsu in order to achieve the predictable result of enhancing the spin injection efficiency (Col 6 Ln 40).

With respect to **claim 75**, Kirczenow teaches a source and a drain (Fig. 5, 54/56) formed with ferromagnetic semiconductors (see Col 13-14, for example CoS_2); a semiconductor layer that is provided associated with the source and the drain, and has a channel of the first conduction type formed therein (Fig. 5, 52); and a gate electrode that is formed as opposed to the semiconductor layer (Fig. 5, 61), wherein the ferromagnetic semiconductors in the source and the drain are directly contacted with the semiconductor channel; but does not teach that the ferromagnetic semiconductors have a different conduction type from the semiconductor layer. Hsu teaches ferromagnetic semiconductors that can be doped to a different conduction type than a semiconductor material (Col 6 Ln 52-58). It would have been obvious to one of ordinary skill in the art at the time the invention was made to doped the ferromagnetic semiconductors of Kirczenow as taught by Hsu in order to achieve the predictable result of forming various pn junctions in the device.

With respect to **claim 77**, Kirczenow does not teach that when the relative magnetization of the ferromagnetic drain with respect to the ferromagnetic source is antiparallel magnetization, the drain current is lower than the drain current in a

case of parallel magnetization. Hsu teaches that when the relative magnetization of the ferromagnetic drain with respect to the ferromagnetic source is antiparallel magnetization, the drain current is lower than the drain current in a case of parallel magnetization (Col 9 Ln 3-8). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the device of Kirczenow so that when the relative magnetization of the ferromagnetic drain with respect to the ferromagnetic source is antiparallel magnetization, the drain current is lower than the drain current in a case of parallel magnetization as taught by Hsu in order to achieve the predictable result of operating the device to provide spin-polarized carriers.

With respect to **claim 78**, Kirczenow does not teach that the trans-conductance can be controlled in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source. Hsu teaches that the trans-conductance can be controlled in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source (Col 2 Ln 61-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the device of Kirczenow so that the trans-conductance can be controlled in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source as taught by Hsu in order to achieve the predictable result of operating the device to provide spin-polarized carriers.

With respect to **claim 79**, Kirczenow does not teach using the transistor, information being stored in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source, the information stored in the transistor being detected based on the transconductance of the transistor depending on the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source. Hsu teaches using the transistor, information being stored in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source, the information stored in the transistor being detected based on the transconductance of the transistor depending on the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source (Col 2 Ln 61-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to store information in the device of Kirczenow as taught by Hsu in order to use the device to store memory data.

Claim 73 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kirczenow and Hsu, in view of Ohno et al (U.S. PG Pub #2001/0031547).

With respect to **claim 73**, Kirczenow does not teach that the semiconductor layer is formed with an undoped semiconductor or an intrinsic semiconductor. Ohno teaches that the semiconductor layer is formed with an undoped semiconductor or an intrinsic semiconductor (Paragraph 28, GaSb). It

would have been obvious to one of ordinary skill in the art at the time the invention was made to use undoped semiconductors in the transistors of Kirczenow as taught by Ohno in order to achieve the predictable result of forming a MOSFET.

Claims 74 and 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kirczenow and Hsu, in view of Johnson.

With respect to **claims 74 and 76**, Kirczenow does not teach that the channel length is equal to or shorter than the mean free path associated with carrier energy relaxation. Johnson teaches that the channel length is equal to or shorter than the mean free path associated with carrier energy relaxation (Col 10 Ln 60-63). It would have been obvious to one of ordinary skill in the art at the time the invention was made to arrange the channel length as taught by Johnson in order to control the resistance between the source and drain.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben P. Sandvik whose telephone number is (571) 272-8446. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on 571-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/B. P. S./
Examiner, Art Unit 2826

/Evan Pert/
Primary Examiner, Art Unit 2826